FLUKE®

ADDENDUM

ADDENDUM TO 8000A DIGITAL MULTIMETER MANUAL FOR 8000A/HV

ADDENDUM TO THE 8000A DIGITAL MULTIMETER INSTRUCTION MANUAL

Preface

This document supplements and, thereby, modifies the Model 8000A Instruction Manual to cover the operation and maintenance of the Model 8000A/HV Digital Multimeter. The supplemental data is presented in the form of additions to the standard instrument, and follows the same sequential arrangement as that of the 8000A Instruction Manual.

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Section 1

Introduction & Specifications

1-1. INTRODUCTION

1-2. The 8000A/HV is a modified 8000A DMM which provides protection against high voltage transients. The 8000A/HV uses M.O.V.'s (metal oxide varistors), to provide the high voltage protection. The M,O.V.'s will safely handle transients up to 6 kV with a maximum duration of 10 usec's when the instrument is measuring Vdc or Vac.

1-3. SPECIFICATIONS

1-4. The 8000A/HV changes the maximum input voltage portion of the DC voltage and AC voltage specifications of the model 8000A as shown in tables 1-1, 1-2 and 1-3.

Table 1-1. Transient Protection Triggering Limits, DCV & ACV

V/Ω Input	Maximum Input Voltage Peak	Pulse Width
Upper Limit	<6KV 3KV	10 usec. 500 usec.

Table 1-2. Accuracy, One Year @ 15°C to 35°C

Function	Range	Input Error
ACV	45 Hz - 5 kHz	±0.6%, +2 digits
ACV	5 kHz - 10 kHz	±1.0% - +2 digits
ACV	10 kHz - 20 kHz	±2.0%, +2 digits
Ohms	200Ω - 2000 KΩ	±0.25%, +1 digit

Table 1-3. Common Mode Rejection in DC

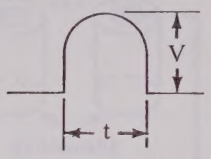
Source Impedance (Unbalanced)	CMR	Frequency
1.0 KΩ	Greater Than 90 dB	0 to 60 Hz
100.0 KΩ	Greater Than 110 dB	0 to 60 Hz

1-5. The transient repetition rate determines the maximum number of pulses/sec the protection circuit can withstand before breakdown. Any pulse below a level of approximately 1700V will not trigger the circuit or affect the measurement.

To determine the maximum repetition rate use the following equation:

Pulses/sec. = 0.84/(V-2000)t

Where: V = Pulse Amplitude



t = Pulse width at 0.707 Point in sec.

Note: Unit may be damaged if the above equation is exceeded.

Section 2

Operating Instructions

2-2. The operation of the 8000A series instrument is not affected by the installation of the HV modification. See 8000A instruction manual for operating instructions. However, the specifications are changed as a result of the HV installation. (See Section 1 of this addendum for changes.)

Section 3

Theory of Operation

3-1. INTRODUCTION

NOTE

The following describes the operation of the model 8000A with the HV modification installed. Refer to Section 3 of the 8000A instruction manual for theory of operation of the 8000A instrument.

3-2. The basis of the high voltage protection circuit is the four metal oxide varistors. (M.O.V.'s) connected between the V/Ω input and the common input, denoted the suppressor leg. A varistor is a nonlinear resistor in which the current varies as a power of the impressed voltage. Therefore, as the impressed voltage increases, the varistors characteristic changes from a high impedance, to a low impedance, high power dissipation device, which shorts the input to ground.

3-3. The following discussion shall classify the effects of the HV modification on the 8000A input signal under

two conditions: #1, input less than, or equal to 1.7 kV DC & AC, and #2, input signal greater than 1.7 kV, but less than 6 kV, DC & AC.

3-4. Condition #1

1. Protection circuit inactive.
2. No current flow through suppressor leg.
3. 8000A instrument in normal mode operation.

3-5. Condition #2

1. Protection circuit active.
2. Current flow through suppressor leg.
3. M.O.V.'s dissapate power.
4. M.O.V.'s resistance decreases.
5. Input effectively grounded.

Section 4

Maintenance

4-1. INTRODUCTION

4-2. The following test and calibration is valid only for the HV modification. For calibration of the 8000A instrument see Section 4 of the 8000A instruction manual.

4-3. TEST AND CALIBRATION

4-4. High Voltage Transient Performance Check

4-5. Any 8000A series instrument should not be damaged by discharging a capacitor of 0.008 uf, charged to 5 kV, into the V/Ω input in any ACV or DCV range. Discharge a capacitor bank into the input terminal at least once in the 1 volt DC range and once in the 1 volt AC range. Refer to Figure 4-1 for a suggested test setup to be used for this test.

WARNING!
USE EXTREME CAUTION WHEN PERFORMING THE FOLLOWING TEST, HIGH VOLTAGE PRESENT AT OUTPUT OF 0.008 μF CAPACITOR.

1. Connect the test set-up as shown in Figure 4-1.
2. Select function - ACV and range 2 on the 8000A instrument.
3. Adjust the Fluke 410B for 5000V DC output.
4. Place the insulated test probe on the 5KV standoff and allow the capacitor bank to charge fully, (1 sec. minimum).

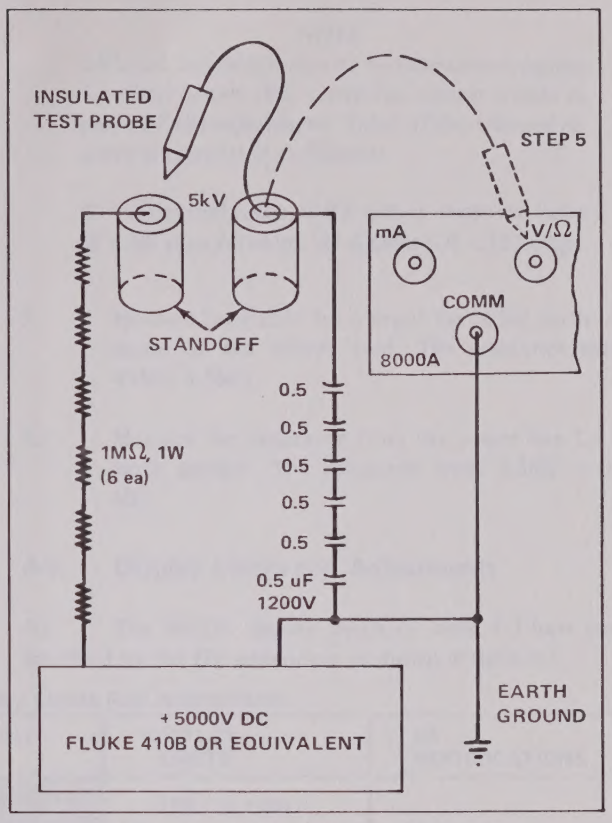


Figure 4-1. 8000A/HV Test Connections

5. Remove the insulated test probe from the 5KV standoff and discharge the capacitor banks through the V/Ω input of the 8000A, by placing the probe to V/Ω input, allow a minimum of one minute for complete discharge.
6. Select the DCV function.
7. Repeat steps 3, 4 and 5.
8. Reduce the output of, or remove the power from 410B.

WARNING!
BE SURE CAPACITOR BANK IS COMPLETELY DISCHARGED.

9. Transient voltage protection circuit test is now complete.

4-6. KΩ Calibration

NOTE
The following calibration is supplementary to range adjustment checks of the 8000A instrument, see Section 4-32, 8000A manual.

1. Select the 200KΩ range, and apply 190.0KΩ to the 8000A input. Adjust R12, (1KΩ cal.), for a reading of 190.0KΩ.

2. Switch instrument to the 2KΩ range and apply 1.9KΩ to the input. Set the 1KΩ cal. adjustment on the transient PCB for a reading of 1.9KΩ.

3. Check the following inputs on the proper range:

19.0KΩ, should read 19.0KΩ ±5 digits
190.0Ω should read 190.0Ω ±5 digits
1.9MΩ should read 1.900KΩ ±5 digits

4-7. K Ohm Calibration, Low Ohm Option.

1. Switch instrument to the 200KΩ range. Apply 190.0KΩ to input and adjust, (KΩ cal.), for a reading of 190.0KΩ.

2. Check the following inputs on the proper range.

1.9MΩ should read 1900KΩ ±5 digits
19.0KΩ should read 19.00KΩ ±5 digits
1.9KΩ should read 1.900KΩ ±5 digits
190.0Ω should read 190.0Ω ±5 digits

NOTE

1KΩ cal. adjust is removed on instruments having Lo ohms option -06. A selected resistor is used in place of the adjustment. Value of the selected resistor is calculated as follows:

R = Measured value of R3 -minus measured value of 9.8K plus 10 ohms. 86.6 Ohm <R <322 Ohm.

3. Measure resistance from input Lo to the earth terminal of the power cord. The resistance reads 47MΩ ±5MΩ.

4. Measure the resistance from the power line Lo to earth ground. The resistance reads 3.3MΩ ± 0.3 MΩ.

4-8. Display Limits and Adjustments

4-9. The 8000A display limits of table 4-3 have been modified by the HV addendum as shown in table 4-1.

Table 4-1. Modified 8000A Display Limits And Adjustments

FUNCTION RANGE	INPUT	ADJUSTMENT	DISPLAY LIMITS	HV MODIFICATIONS
DCV/200 MV	+190 MV	"200 MVDC" (R23) Adjust for +190.0	+189.7 to +190.3	
DCV/2	+1.9V dc	"2 VDC" (R25) Adjust for +1.900	+1.897 to +1.903	
DCV/20	+19V dc		+18.97 to 19.03	
DCV/200	+190V dc		+189.7 to +190.3	
DCV/1200V	+1000V dc		+998 to +1002	
20 MΩ [1]	19 MΩ	"20 M" (R55) Adjust for 19.00	18.89 to 19.11	
KΩ/20	19 KΩ	"K OHM" (R12) Adjust for 19.00	18.95 to 19.05	18.94 to 19.06
KΩ/200Ω	190Ω		189.5 to 190.5	189.4 to 19.06
KΩ/2	1.9KΩ		1.895 to 1.905	1.894 to 1.906
KΩ/200	190 KΩ		189.5 to 190.5	189.4 to 198.6
KΩ/2000 KΩ	1.9 MΩ		1895 to 1905	1894 to 1906
DC MA /200 μA	+190 μA		+189.3 to +190.7	
DC MA / 2	+1.9 mA		+1.893 to +1.907	
DC MA / 20	+19 mA		+18.93 to +19.07	
DC MA / 200	+190 mA		+189.3 to +190.7	
DC MA / 2000 MA	+1.9A		+1893 to 1907	
ACV / 200 MV	190mV@100Hz		188.8 to 191.2	188.7 to 191.3
ACV / 200 MV	190mV @20 kHz		187.9 to 192.1	186.0 to 1940
ACV / 2	1.9V @ 100 Hz		1.888 to 1.912	1.887 to 1.913
ACV / 2	1.9V@20 kHz		1.879 to 1.921	1.860 to 1.940
ACV / 2	1.9V@20 kHz		1.879 to 1.921	18.60 to 19.40
ACV / 20	19V@20 kHz	"HF ADJ" (C3) Adjust for 19.00	18.79 to 19.21	
ACV / 20	19V@10 kHz		188.88 to 19.12	18.79 to 19.21
ACV / 200	190V @10 kHz		187.9 to 192.1	187.9 to 192.1
ACV / 200	190 @ 20 kHz		187.9 to 192.1	186.0 to 194.0
ACV / 1200V	1000V@100 Hz		993 to 1007	992 to 1008
ACV / 1200V	1000V @10 kHz		988 to 1012	988 to 1012
LO Ω / 20	SHORT	NULL	0.00	
[2]	19Ω	LO OHM (R78) Adjust for 19.00	18.88 to 19.12	
LO Ω / 2	SHORT	NULL	0.00	
[2]	1.9Ω		1.879 to 1.921	

[1] The 20 MΩ function is not included on instruments with the –06 Option (LO Ω).

[2] The LO Ω function is only included on instruments with the –06 Option. Refer to Section 6 of the 8000A Instruction Manual for operating instructions.

Section 5

Lists of Replaceable Parts

5-1. INTRODUCTION

5-2. A list of replaceable parts is given in table 5-1, component location and schematic are shown in Figure 5-1, 5-2, and 5-3.

5-3. HOW TO OBTAIN PARTS

5-4. Components may be ordered directly from the manufacturer by using the manufacturer's part number, or from the John Fluke Mfg. Co., Inc. factory or authorized representative by using the FLUKE STOCK NUMBER. In the event the part you order has been replaced by a new or improved part, the replacement will be accompanied by an explanatory note and installation instructions, if necessary. For proper ordering procedure see 8000A manual Section –5.

Table 5-1. Final Assembly Model 8000A/HV

REF DESIG OR ITEM NO.	DESCRIPTION	FLUKE STOCK NO.	MFG FED SPLY CDE	MFG PART. NO. OR TYPE	TOT QTY	REC QTY	USE CDE
	FINAL ASSEMBLY MODEL 8000A/HV						
A4	Model 8000A - DMM				1		
A5	Transient Suppressor PCB Assy				1		
A6	HV Main PCB Assembly				1		
A4	**MODEL 8000A - DMM (see 8000A Parts List)**				REF		
A5	**TRANSIENT SUPPRESSOR PCB ASSEMBLY See Figure 5-1**				REF		
R86	Res, Fi, Hi-voltage 9.8K, 1%, 5.0W	423996	89536	423996	1	1	
R88	Res, ww, var, 500 type 110, 1/4W	112433	89536	112433	1	1	
RV1	Varistor high voltage, 390V, ±10%, 0.6 Joules	423475	09214	V390MAX781	2		
RV2	Varistor high voltage, 534V, ±15%, 2.0 Joules	443192	09214	V300LA2	3		
A6	**HV MAIN PCB ASSEMBLY See Figure 5-1 and 5-2**				REF		
C72	Cap, cer, 0.003 μF, ±20%	106674	56289	C023B102-F332N	1		
R83	Res, comp, 3.3M, 5.0%, 1/4W [1]	208389	01121	CB3355	1		
R84	Res, comp, 15K, 10%, 1.W	109421	01121	GB1531	1		
R85	Res, MF, 900K 0.1%, 1/4W	225755	91637	MFF1-49003B	1		
R87	Res, comp, 100M, ±10%, 1/2W	190520	01121	EB1071	1		
R89	Res, comp, 47M, ±5%, 1/4W [1]	447516	01121	CB4765	1		
	Insulator, AC Shield	456657	89536	456657	1		
	[1] See Figure (5-2) For Land Pattern						

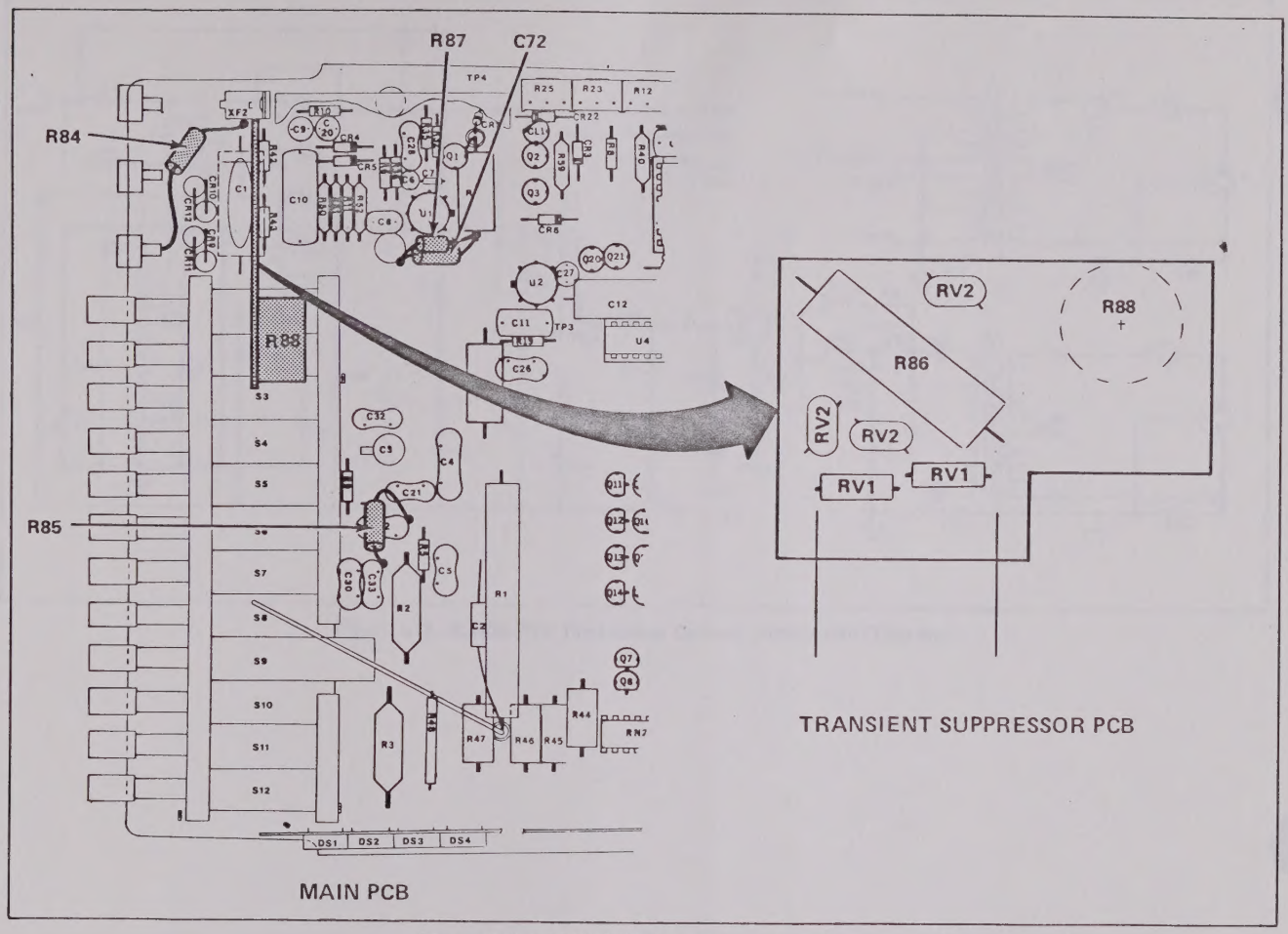


Figure 5-1. 8000A/HV Component Locations

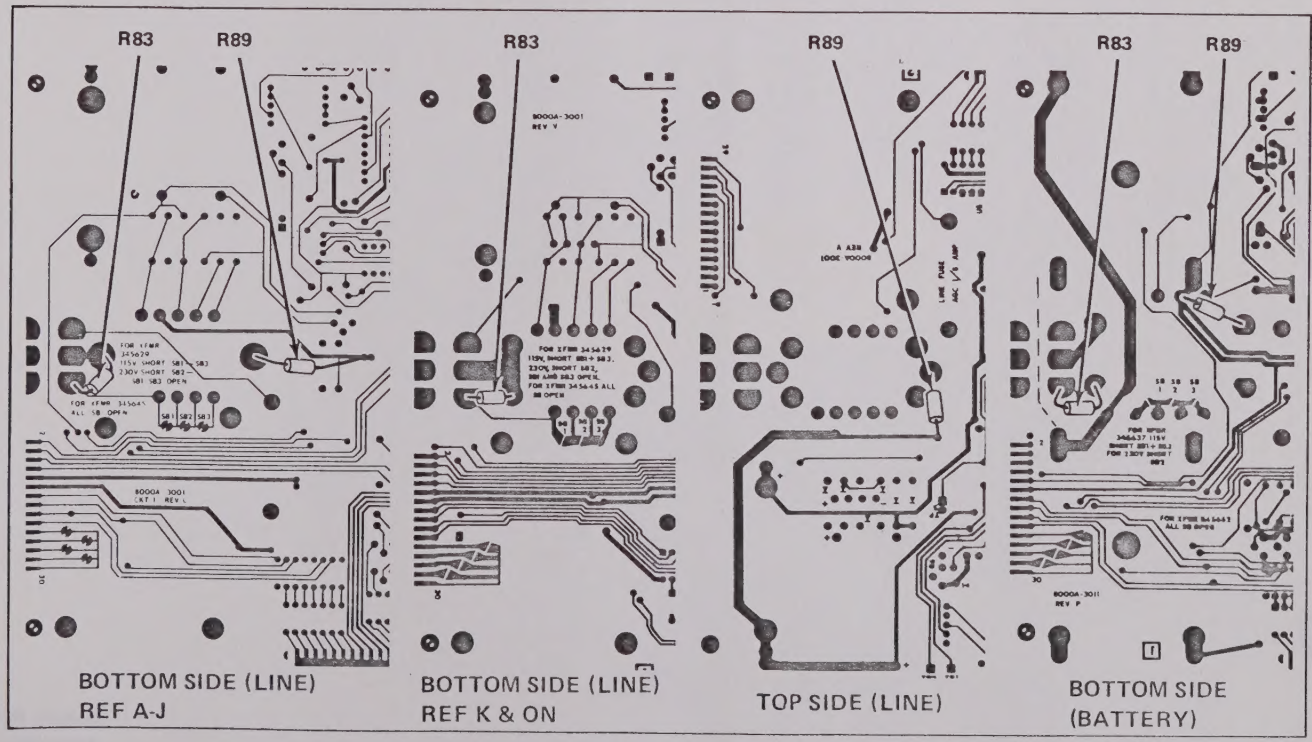


Figure 5-2. 8000A/HV Main PCB Component Locations

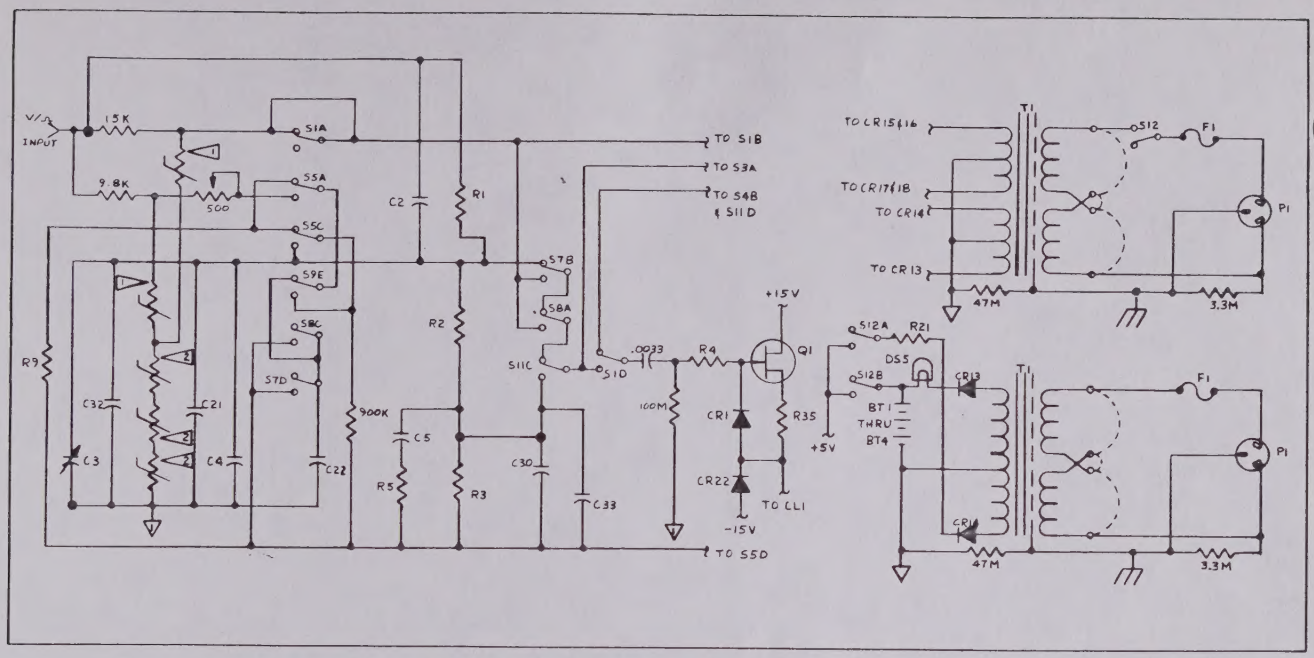


Figure 5-3. 8000A/HV Protection Circuit, Schematic Diagram.

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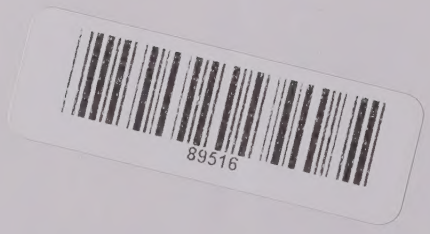
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